Cheque Standards and Specifications

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1. Introduction and Scope

Under the Electronic Image-based Cheque Clearing System authorized by Nepal Rastra Bank (NRB) – the Central Bank of Nepal and operated by the Nepal Clearing House Limited (NCHL), Cheques will be processed by Electronic Cheque Scanners. This shall require all Banks that are participating in the Cheque clearing process to adopt a MICR line encoded Cheque layout that follows standard specifications that conform to imaging and security requirements. Improving the quality of MICR printing and using of images for clearing depends on a number of factors viz. Design, layout, background colour, screening, background pattern, security features, ink used to print MICR data and other required information and maintenance of MICR printing machines. Therefore, it is imperative that the Cheque design and layout are standardized.

This document has been prepared in consultation with printing presses, and reviewing Cheques design standards issued by a number of central Banks and monetary authorities. The explicit standards specified in this document provide mandatory requirements for designing and printing of paper Cheques that are cleared and settled between the Banks in Nepal, including those printed by Banks‟ corporate customers unless specifically indicated otherwise.

The Cheque Standards and Specification is not intended as a comprehensive guide to printing presses, who shall refer to the respective trade publications and international standards relating to printing of Cheques for up-to-date methods and techniques to print the Cheques with the required standards. Since the Cheque specifications are typically stated in imperial unit measurements, this document quotes all measurement calculations in imperial measurements along with the equivalent metric values to the nearest millimeter (MM) are given in brackets.

2. Cheque Dimensions

There shall be only one standard size for all Cheques and other MICR encoded payment instruments that are cleared by the Clearing House to facilitate easy and efficient handling of Cheques. The Cheque shall be rectangular in shape. The length shall be seven and a half (7½) inches (190.5 mm) and the height shall be three and a half (3½) inches (88.9 mm), excluding Cheque stubs and other attachments.

3. Cheque Layout

A Cheque is a document which shall be easily readable by the human eye or by a machine regardless of the manner in which it is completed. Therefore, it is imperative to have a standard layout which contains fields or areas that are legally required or desired by the Banks, their corporate customers, or the Clearing House for:

- Insertion or filling of mandatory information to make a payment,
- Banks to exercise reasonable care in authorising a Cheque, and
- Manual or electronic processing.

All information requirements stated in this Cheque Standards and Specifications shall be present on the face of the Cheque, unless specifically indicated otherwise.

The efficiency of Cheque processing to a large extent depends on the quality and of required information entered on the specific field or area and the means of entry. Banks shall observe the requirements for the dimensions of each mandatory field. Except where specifically stated, dimensions depend on the amount of information needed to be entered and the means of entry. All horizontal dimensions shall be measured from the right reference edge and all vertical dimensions shall be measured from the bottom reference edge. Therefore, right and bottom reference edges are referred to as reference edges. In the case of Cheques printed in continuous form, measurements may be taken from the perforations. The label of each area needs to be printed in Nepali and English.

4. Front Side of the Cheque

Front side of the Cheque is broadly divided into two areas: MICR clear band area and business area. Information in the Business Area is categorised into two: mandatory information, which have a specific location and optional information (non-specific location information). The layout of the front and the reverse side of the new Cheque are given at Annexure I and II. Details of the Cheque layout are explained below with cross reference labels in Annexure III and IV in brackets. If a Bank or its corporate customer decides to print any non-specific location information, it shall not be printed in the clear band areas and shall not interfere with any mandatory information of the Cheque. However, this non-specific location information too is required to be legible to ensure image representation of the Cheque.

5. Clear Band Areas

In a Cheque, the following clear bands shall be maintained:

- MICR clear band - 6/8 inch (19.050 mm) measured vertically from the bottom of the Cheque (Item no. 1A in Annexure III);
- 1/4 inch (6.35mm) clear band on left (Item no. 1B in Annexure III) and right sides (Item no. 1C in Annexure III) of the Cheque; and
- 1/8 inch (3.175mm) clear band on the top of the Cheque (Item no. 1D in Annexure III).

The MICR clear band area runs from the right to the left vertical edges of a Cheque along the bottom reference edge on the face and the reverse of the Cheque. The MICR clear band area in the face of the Cheque shall be reserved for printing of MICR information and shall be free of any colour or background printing except for the paper watermark as by the manufacturing of the Cheque paper supplier. The MICR line shall comply with the standards specified in its section below later in this document.

Except backgrounds, no other writing or printing is permitted in other clear bands (at left, right and top sides of the Cheque). Background in other clear band areas may be printed using a scan non-readable ink.

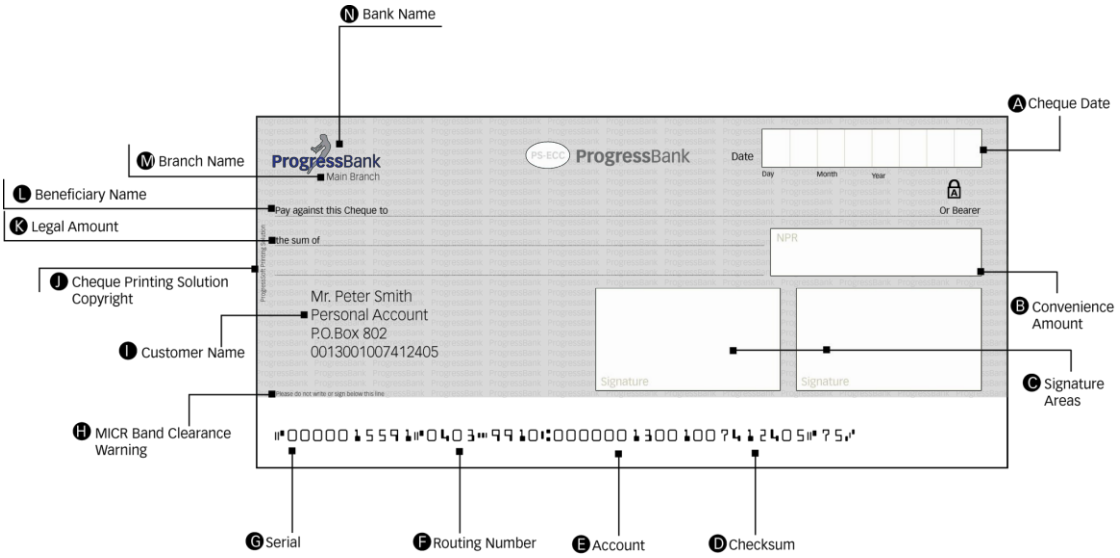


Figure 1: General Cheque layout (as in Annexure I)

6. Business Area

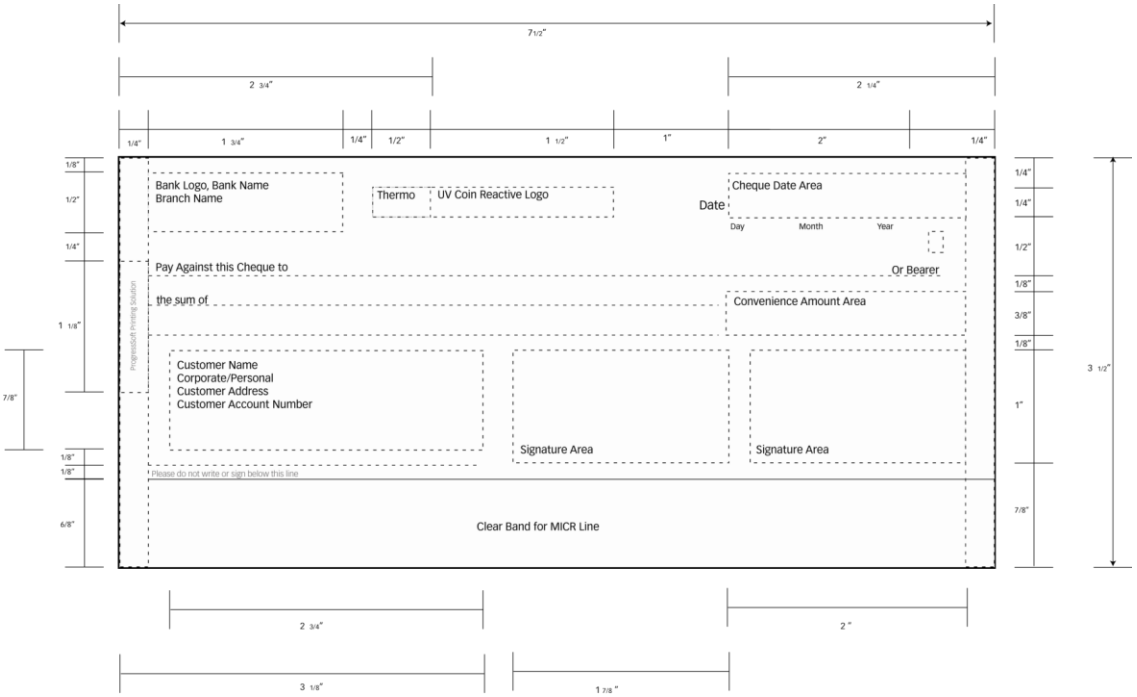


Figure 2: Cheque field locations (as in Annexure III)

6.1. Date Field (Item no. 2 in Annexure III)

The Cheque shall have a common format to facilitate easy recognition of the date. The area shall include the “Date” field label and a constraint date box (with a separate box for each digit). The outline of the date box shall be printed as scan non-readable in a colour such that the Print Contrast Signals (PCS) of the outline with respect to its background does not exceed 0.30.

In cases where the date is printed by a software application and positioning within the box is difficult, the constraint date box or field indicator may not be required. However, the format and the location of the date shall be as specified by the Cheque Standards and Specifications.

6.1.1. Constraint Date Box (Item no. 2A in Annexure III)

The date box shall have a common format of DDMMYYYY to encourage a standardised numeric representation of the date. The first two digits of the constraint box to write the day, the month in the next two digits, and the year in the last four digits. Spaces, slashes, dots or other symbols as separators are not permitted.

The date box is fragmented into eight separate rectangles to have each date digit handwritten or printed out in its separate field area.

6.1.2. Date Field Indicators (Item no. 2B in Annexure III)

The Field Indicators “Day”, “Month”, and “Year” shall be clearly printed below the date box to guide the drawer. The Print Contrast Signal (PCS) of the Field Indicator with respect to the background shall be at least 0.60.

6.1.3. Location of Date Field

The recommended position for the date field is the top right corner of the Cheque above the amount in figures area.

Location	Specifications
Width	2” (50.8 mm)
Height	3/8” (9.525 mm)
Distance of the upper edge of the constraint date box from the bottom reference edge of the Cheque	3 2/8” (82.55 mm)
Distance of the lower edge of the constraint date box from the bottom reference edge of the Cheque	2 7/8” (73.025 mm)
Distance of the right edge of the constraint date box from the right reference edge of the Cheque	1/4” (6.35 mm)
Distance of the left edge of the constraint date box from the right reference edge of the Cheque	2 1/4” (57.15 mm)

Table1: Location of date field (as in Annexure III)

6.1.4. Date label (Item no. 2C in Annexure III)

The “Date” label shall be printed to the left of the date Box.

6.2. Payee Name (Item no. 3 in Annexure III)

Payee name field is a mandatory field and shall be positioned in a manner which is easily recognisable. The location for the payee name shall be on the left end of the Cheque, below the issuing Bank name and shall be above the amount in words area. That is 2½ inches (63.5 mm) from the bottom reference edge. The line for entering payee name shall be printed as scan non-readable. The field for payee name shall not interfere with the other information.

6.2.1. Pay Label (Item no. 3A in Annexure III)

The "Pay against this Cheque to" label shall be printed immediately to the left of the space, where the payee name will be written or inserted. The label should be placed right above the scan non-readable line of the payee name.

6.2.2. Or Bearer Label (Item no. 3B in Annexure III)

The label "Or Bearer" shall be printed at the end of the payee line, where the payee name will be inserted. It shall be printed at least ¼ inch (6.35 mm) from the right reference edge and immediately above the amount in figures box at a distance of 3/8 inch.

6.3. Amount in Words also known as "Legal Amount" (Item no. 4 in Annexure III)

The amount in words shall be a mandatory field and the Cheque layout must enable the correct amount of the Cheque to be easily determined at a glance. It shall be free of any other printing, enabling the human eye to detect any fraudulent alterations by examining the original physical Cheque or its image. The area for amount in words shall be provided to the left of the amount in figures box and below the payee name field. The space shall be two lines at 1 5/8 inches (41.275mm) and 2 inches (50.8mm) above the bottom reference edge. The right end limit of the amount in words lines shall be 2 3/4 (69.85 mm) inches from the right reference edge. The said two lines shall be printed as scan non-readable. When the amount in words is to be inserted by a machine, scan readable asterisks (*) shall be inserted before the amount in words.

6.3.1. Amount Label (Item no. 4A in Annexure III)

The position for the amount label i.e. "the sum of" shall be located below the pay label i.e. "Pay against this Cheque to" label and at the beginning of the amount in words Line.

6.4. Amount in Figures Field (also known as "Convenience Amount" Item no. 5 in Annexure III)

The amount in figures shall be a mandatory field. The Cheque layout must enable the value of the Cheque to be quickly and accurately determined at a glance. The amount in figures field shall be an imaginary rectangular area or a box at the right hand side of the Cheque. The location and format of the amount in figures shall be common to all Cheques. The location of the said field is below the "Or Bearer" label and right to the area of amount in words. Any information shall not show to the right of amount in figures.

6.4.1. Location of the Amount in Figures Field

The amount in figures shall be filled in the amount in figure box.

Dimensions for the Imaginary Rectangle	Specifications
Width	2 1/4" (57.15 mm)
Height	1/2" (12.7 mm)
Distance of the lower edge of the rectangle from the bottom reference edge of Cheque	1 5/8" (41.275 mm)
Distance of the upper edge of the rectangle from the bottom reference edge of Cheque	2 1/8" (53.975 mm)
Distance of the right hand edge of the rectangle from the right hand reference edge of Cheque	¼"(6.35 mm)
Distance of the left hand edge of the rectangle from the right hand reference edge of Cheque	2 ½"(63.5 mm)

Table2: Location of amount in figures field (as in Annexure III)

6.4.2. Location of the Currency Symbol (Item no. 5A in Annexure III)

The currency symbol for Nepalese Rupee Cheques i.e. "NPR" shall be pre- printed in black as scan readable inside the amount in figures box to the left and centered vertically on the box and 2½ inches (63.5 mm) from the right reference edge. There shall be a spacing of not more than 0.015 inch (0.381 mm) after the line of the box and between "NPR" letters. The currency symbol shall not be slanted.

6.4.3. Printing of and Writing in the Amount in Figures Box

To facilitate better value recognition, it is recommended to print the background security pattern or screen in scan non readable ink inside the amount in figures box. A clear area of 1/8 inches (3.175 mm) shall be provided around the amount in figures box to facilitate value recognition.

The amount in figures shall be written or printed immediately after the currency symbol to avoid any fraudulent alteration of the amount in figures.

Where the amount in figures is machine-printed or computer printed, the currency symbol shall be printed together with the amount in figures. Protecting asterisks (*) may be printed after the "NPR" label and before the amount in figures, where the amount in figures is machine printed or computer printed; in this case the protecting asterisks (*) to be printed as scan readable.

6.5. Drawer Signature Field (Item no. 6 in Annexure III)

The drawer signature areas shall be a mandatory fields and be designed so that the signature(s) of the drawer(s) can be easily located. They shall be at the bottom of the Cheque with sufficient space separating it from the clear band area in order to ensure that a signature does not encroach upon the MICR clear band area.

6.5.1. Drawer Signature Boxes (Item no. 6 A in Annexure III)

The drawer signature boxes shall be at the bottom of the Cheque. The drawer signature boxes shall be located ¼ inch (6.35 mm) above the MICR clear band area and ¼ inch (6.35 mm) away from the right reference edge of the Cheque. Each box is separated from its adjacent box by ¼ inch (6.35 mm).

The maximum distance of the drawer signature boxes from the right reference edge of the Cheques shall be 4 inches (101.6 mm). Where multiple signatures are required, all signatures may be placed within signature boxes. The signature boxes shall be printed above the wording, “Please do not write or sign below this line". The drawer signature boxes and wording shall be printed as scan non-readable.

6.5.2. Signature Label (Item no. 6B in Annexure III)

The signature label “Signature“ shall be printed immediately to the left bottom of the space, where the drawer signature will be placed.

6.6. Drawee Bank Information (Item no. 7 in Annexure III)

The drawee Bank information shall be printed in a visually clear print to be prominent against all other information on the Cheque.

6.6.1. Drawee Bank Logo, Bank Name, Branch Name and Address

The location of the Bank logo, Bank name, branch name and branch address is at the top left corner.

6.7. Drawer Information (Item no. 8 in Annexure III)

Drawer information provides personal details of the Bank"s customer, shall be a mandatory requirement.

6.7.1. Area for Drawer Information

The drawer"s (corporate or personal) name, logo, address and account number shall be adjacent to the left of the signature and above the clear band area. They shall not be more prominent than the information on drawee Bank as to be mistaken for the name of the drawee Bank. They shall also not interfere with the signature box area or the MICR clear band area. The company stamp, personal seal or advertisement on the Cheque are not permitted.

6.8. Cheque Printing Press (Item no. 9 in Annexure III)

The name of the printing press shall be printed vertically on the face of the Cheque on the extreme left-hand edge of the Cheque using a small but legible font.

6.9. Area for Cheque Serial Number (optional)

Banks may decide on their own requirements to print the Cheque serial number (apart from the MICR line) on the face of the Cheque. However, its positioning shall not interfere with any mandatory information on the Cheque.

6.10. Pre-printed Crossing

Any crossing shall not encroach upon any mandatory information on the

7. Cheque or the MICR clear band

7.1. Back of the Cheque

The layout of the back of the Cheque shall be standardised to provide information relating to deposit, endorsements and clearing. The right portion of the reverse side of the Cheque (3 1/2 inch or 88.9 mm in width), shall be allocated for endorsements of the payee and the presenting Bank or the Bank of first deposit (18 in Annexure II). No writing or any form of interference in the MICR clear band area on the back side of the Cheque is permitted, to ensure accurate reading of MICR printing. Dimensions are found in Annexure IV.

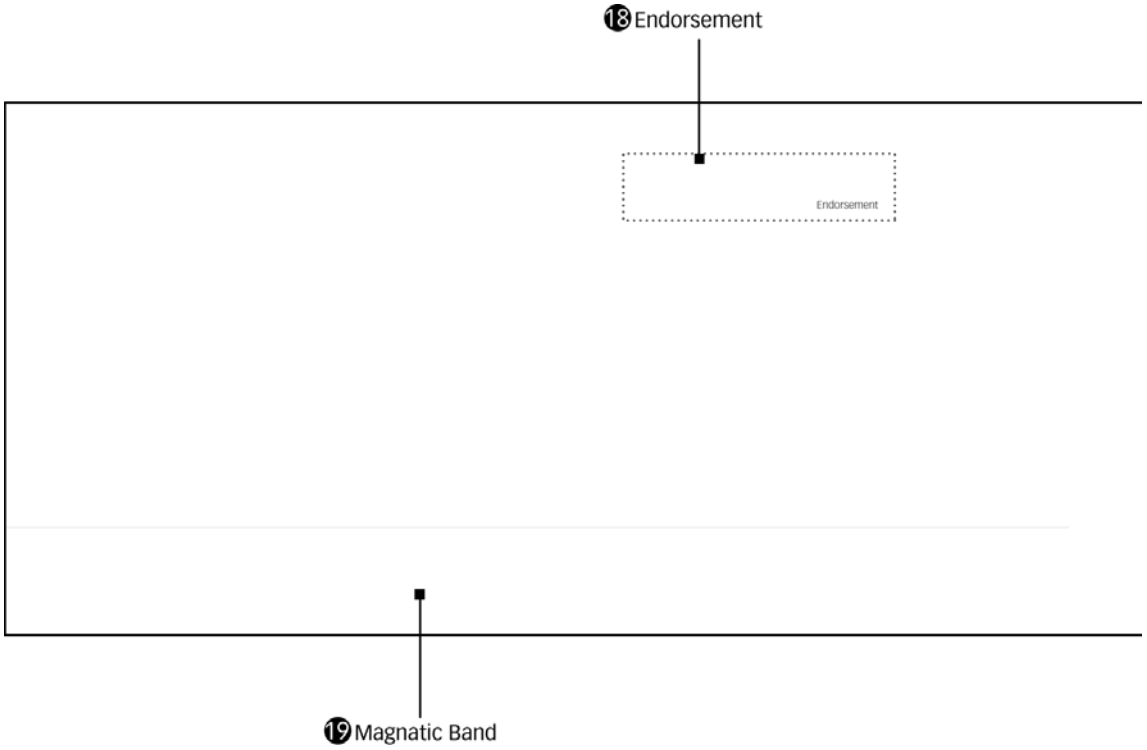


Figure3: Back of the Cheque (as in Annexure II)

8. MICR Code line Structure, Specifications and Encoding

The following new specification in respect of MICR code line shall apply, unless specifically indicated otherwise.

8.1. MICR Code Line Font

The font for printing of the MICR code line shall be E-13B, which can be readily recognised by high speed magnetic recognition equipment.

The E-13B MICR font consists of ten numerals (0-9) and four following symbols:

Figure4: E-13B MICR font character set

8.1.1. Transit Symbol or Sorting Code Symbol

Transit symbols indicate to the reader sorter that the numerals between those symbols are the routing number (sorting code) that identifies the Bank on which the Cheque is drawn and where the document should be sent for processing.

8.1.2. Amount Symbol

Amount symbol indicates to the reader sorter the boundaries of the amount field. The amount of the Cheque is appearing between the two amount symbols.

8.1.3. 'On us' Symbol

The 'on us' symbol indicates to the reader sorter where to start reading the account number and where to start and finish reading the Cheque serial number

8.1.4. Dash Symbol

„Dash" symbol indicates a divider or hyphen to the reader sorter. The „dash" symbol is used to separate the Bank branch code from the Bank Code.

8.2. MICR Code Line Contents and Format

The MICR code line is divided into five fields. Every field shall be closed either by the appropriate closing symbol or by the opening symbol of the following field.

The fields of the MICR code line in the clear band area shall be read from the right edge of the Cheque:

Field	Maximum Size
Amount Field	13
Checksum Code	2
Account Number	20
Bank and Branch Codes	8
Cheque Serial Number	10

Table3: MICR line encoding fields (as in Annexure V)

An example of the MICR code line is shown in Annexure V

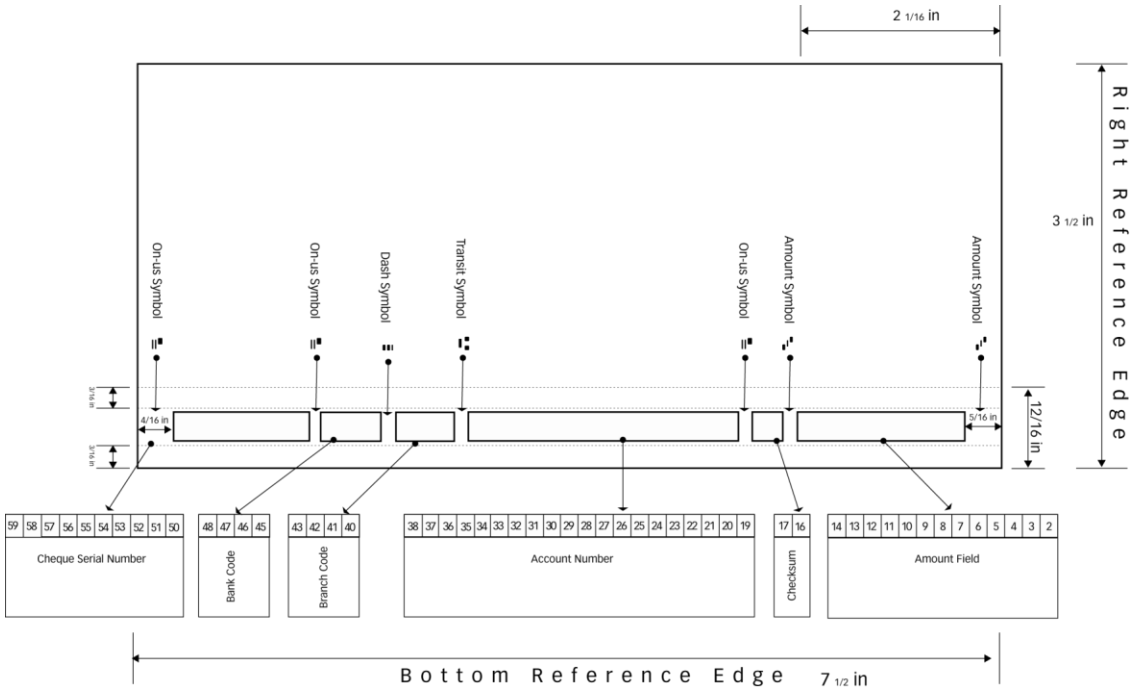


Figure5: MICR line encoding locations and details (as in Annexure V)

8.2.1. Position 1: Amount Symbol

The amount symbol at the position 1 is mandatory as the opening symbol of the amount field. The right edge of the amount symbol shall be 5/16 inch (7.9375 mm) +/- 1/16 inch (1.5875 mm) measured from the right reference edge.

8.2.2. Position 2-14: Amount Field

The amount field is fixed in length and in position (position 2 to 14 consists of thirteen digits). This field shows the actual amount. The amount field is right justified and a digit shall be printed in each position. All unused positions to the left are filled in with zeros. The MICR character set does not have a comma or decimal point. Accordingly, the amount is encoded as a string of numerals with an implied decimal. (Example: an amount of NPR 1,234.50 is encoded as 123450). The maximum amount a Cheque can hold is NPR 10,000,000,000.00. Under normal circumstances; this field is added later by the presenting Bank.

8.2.3. Position 15: Amount Symbol

The amount symbol at the position 15 is mandatory as a closing symbol of the Amount Field.

8.2.4. Position 16-17: Checksum Code Field

The checksum code field is to hold the checksum of all pre-printed MICR digits not including symbol characters. This field at positions 16-17 has a fixed length of two spaces. If the checksum be less than 10 it should be preceded by a 0 digit. Checksum of 9 is 09. The right edge of the checksum code field shall be 2 3/16 inches (55.5625 mm) from the Right Reference Edge of the Cheque.

The checksum formula is an LUHN algorithm with MOD100 base. An example is provided in Annexes IX with the calculation approach.

8.2.5. Position 18: 'on us'

The 'on us' at the position 18 is mandatory as an opening symbol of the account number field.

8.2.6. Position 19-38: Account Number

The account number field is fixed in length (with 20 spaces) and positions are 19-38. Accordingly, a zero shall be printed in each remaining blank position.

8.2.7. Position 39: Transit Symbol

The transit symbol at position 39 is mandatory as an opening symbol of the Bank and branch codes.

8.2.8. Position 40-43: Branch Code or Secondary Sorting Code

The Branch Code (at 40-43) is fixed in position and in length (four digits for Bank code). The Branch Code shall be separated from the Bank Code on its left by the dash or separator symbol, each single digit code of Branch code to be filled with a zero.

8.2.9. Position 44: Dash Symbol

The dash symbol at position 44 is mandatory as a separator between the Bank and the Branch codes.

8.2.10. Position 45-48: Bank Code or Primary Sorting Code

The Bank code (at 45-48) is fixed in position and in length (four digits for Bank code). The bank Code shall be separated from the Branch Code on its right by the dash or separator symbol, each single digit code of Bank code to be filled with a zero.

8.2.11. Position 49: 'on us' Symbol

The 'on us' symbol shall be printed in position 49 in all Cheques as an opening symbol of the Cheque serial number field.

8.2.12. Position 50-59: Cheque Serial Number

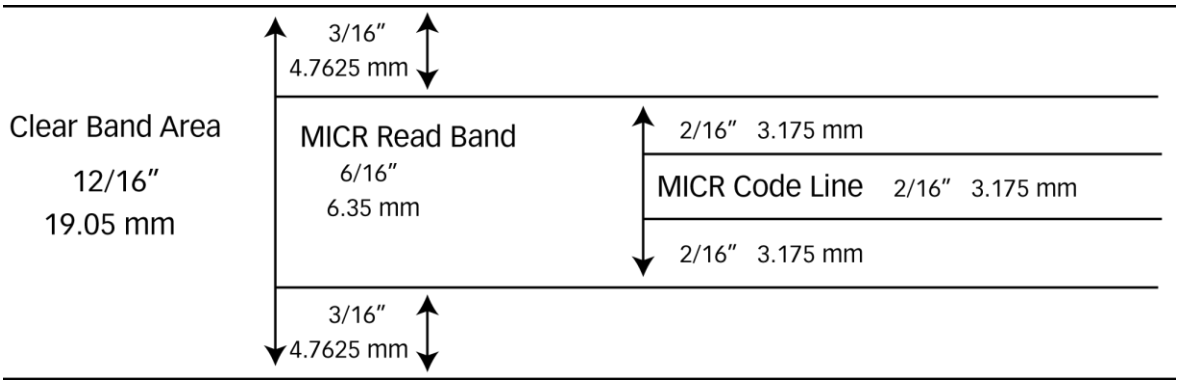
Ten spaces are allocated for the Cheque serial number or Cheque number.

8.2.13. Position 60: 'on us' Symbol

The 'on us' symbol shall be printed in the position 60 in Cheques as a closing symbol of the Cheque serial number field.

8.3. Location and Dimensions of the MICR Code Line

The MICR code line shall be printed within a band of 2/16 inch +/- 1/16 inch (3.175 mm +/- 1.5875 mm) in the clear band area at 4/16 inch (6.35 mm) above the bottom reference edge and parallel to that edge (figure 1). Accordingly in the clear band area, there shall be a MICR Read Band Area of ¼ inch (6.35 mm) high and 3/16 inch (4.7625 mm) above the bottom reference edge. The right margin of the MICR code line shall be 5/16 inch (7.9375 mm) +/- 1/16 inch (1.5875 mm) measured from the right reference edge of the Cheque to the right edge of the opening symbol for the amount field. A left margin of 4/16 inch (6.35 mm) or more shall be provided.



8.4. Ink and MICR Code Line Printing

All MICR characters shall be printed in a single line within the clear band. Only black magnetic ink, which can be magnetised and sensitised, shall be used in printing E-13B characters in the MICR code line. The E-13B characters shall be printed in accordance with the technical specifications of E-13B characters and magnetic ink prescribed by the International Standardisation Organisation. Since the MICR code line data considered as electronic payment information, the ink, print precision and print quality shall facilitate easy recognition of the MICR code line by Cheque scanning and other Cheque processing equipment.

The MICR clear band area shall remain free of background screening. Other than the prescribed MICR characters in the MICR encoding line, no writing, stamping, perforation, stapling or any other intrusion shall be allowed on this area. The E-13B characters shall not be printed in other areas of the Cheque. The horizontal positioning of the fields may vary +/- 1/16 inch (1.5875 mm) either left or right of the field boundaries given above. If adjacent fields of the MICR code line are printed at different time intervals or by applying different printing techniques, a minimum of one blank space shall be maintained between the fields.

The alignment of the bottom edge of any two adjacent numerical MICR characters shall not vary more than 0.007 inch (0.1778mm) within any one field.

The skew or tilt of any character or line shall not be more than 1 ½ degrees off vertical (either one way or the other), using the bottom reference edge of the Cheque as a horizontal reference.

The distance between the right average edges of adjoining characters of the MICR

code line shall be 0.125 inch (3.175mm) +/- 0.010 inch (0.254mm) in the amount field and the Bank/branch field. The distance between right average edges of adjoining characters of the Account number and the Cheque serial number fields shall not be less than 0.115 inch (2.921 mm).

Extraneous magnetic ink areas; voids; fade ink, negative or positive embossment within a character and any irregularity of characters, shall be avoided to ensure the quality of MICR printing. Extraneous magnetic ink areas larger than 0.003 inch x 0.003 inch (0.0762 mm x 0.0762 mm) shall not be in the MICR clear band.

The field"s viz. checksum code, account number, Bank/branch code and the Cheque serial number shall be encoded by the Cheque printing press. The drawee Bank shall exercise adequate care in verifying the accuracy of information in those fields before giving their approval to the proofs. The presenting Bank shall encode the amount field.

9. Cheque Printing

9.1. Physical Characteristics of the Cheque Paper

The paper on which Cheques, other MICR encoded payment instruments are printed shall confirm to minimum paper specifications given below to enhance operational efficiency of MICR readers, sorters and imaging equipment irrespective of grain direction. The paper to be used in printing of Cheques shall confirm to London Banks Paper Specifications No. 1 (CBS 1) specifications.

Description	Technical Specifications
Grammage/ BASIS WEIGHT	Min: 95.0 g/m 2 grams per square metre or G.S.M.
Thickness	Min. :105 micrometers (m/meters) Max. :130 m/meters
Bendtsen Roughness for both surfaces	Maximum 150ml/min
Stiffness	Machine Direction: Min. 7.9 mN Cross Direction: Min 3.1 mN
Air Resistance(Gurley method)	Min: 27s/100ml or equivalent value derived using alternative test methods
Internal Tearing Resistance	Both Directions

Table4: Cheque physical paper specifications

Banks are encouraged to use long grain paper (grain of the paper should run parallel with the base of Cheque), which improve the quality of physical Cheque handling. Printers shall follow standards of International Standards Organisation (ISO) to maintain high standards required in papers for printing of Cheques.

9.2. Quality of the Paper

Cheque printing paper shall:

- Be white, smooth, flat and free from embossment, heavy engraving and excessive tendency to curl;
- Be free from holes, tears, and damages edges;
- Have a relatively lower level of visible spots and fibre contamination to avoid any misreading of information or UV features on the Cheques.

9.3. Chemical Sensitivity

The Cheque printing paper shall have chemical sensitivity to acid, alkaline bleach and polar organic solvents and proprietary ink eradicators that will provide visible evidence of fraudulent alterations.

9.4. Reflectance of the Paper

The reflectance of the paper shall be maintained at a high level (78-80 %). The paper shall be free from following factors, which can adversely affect reflectance:

- magnetic or metallic inclusions ;
- carbonising on the reverse side;
- chemical coating; and
- contamination by fluorescent;

9.5. Perforation and Trimming

The edges of Cheques shall be clean and sharp to minimise the possibility of mutilation and processing problems. Perforations shall give a clear tear. Perforations at the right and bottom edge of the Cheque shall be avoided. The Cheques printed in continuous form shall have “deep cut” perforation. Any Cheque stubs joined to the Cheques shall be printed to the left of the Cheques. Pinhole perforation is not permitted.

9.6. Multi-copies Cheques

In the case of multi copies Cheques, the original copy shall not be coated on the reverse with any carbon or carbon-back ink or carbonless paper for transfer to the second copy, to avoid any black patches in the images of the back side of the Cheque.

10. Standards and Specifications for Image Friendly Cheques

A Cheque Truncation System (an Image-Based Cheques Clearing Process) will be introduced in Nepal. Therefore, it is required to put in place new standards to ensure clarity of the Cheque image. Image technology eliminates the colour of the Cheque and converts the physical Cheque into a digitised format in a grey scale and/or black and white for electronic processing and storage by using computer hardware and software. Such transformation requires introducing Cheques with image friendly features over and above those features required to ensure accurate value recognition of a physical Cheque.

Under an imaging environment, the contrast between the written information and the printed background will become a critical factor for reliable detection and recognition of information on the Cheques by the human eye. The background colour, screening, background pattern, security patterns and the ink used to print the data have a significant bearing on successful imaging and recognition. The impact of all these factors is often measured by reflectance and contrast measurements. The difference of reflectance of a printed or written information field and an adjacent background area can be measured by the print contrast signal (PCS). However, PCS measurements are not always sufficient to determine precisely what will remain in a black and white image. The process of dynamic thresholding (the process used to convert a greyscale image into a binary i.e. black and white image) is generally used to ensure legibility and efficient processing of Cheques.

Electronic imaging requires the overall design of the Cheque to facilitate vital information (printed and hand-written) to be readily legible when viewing its image, rather than the physical Cheque itself. The image friendly Cheques ensure:

- Capturing of all essential information by the imaging process;
- Usability and legibility ; and
- Small file sizes of electronic images, which will help to move and store such captured images in an economical manner.

The success of reproducing a Cheque as an image via scanning largely depends on the depth of shade or colour of ink to be used in the printed Cheque. The legibility of essential information in the Cheque will largely depend on the contrast between the written or printed information and the printed background. All information whether hand-written or machine printed, must be printed in a colour which can be recognised by the scanner. Accordingly, inks can be classified as scan readable

or scan non-readable.

Image scanners reproduce dark colours in Cheques as black and do not reproduce any pastel colours. Any printed or written text on a dark background is usually difficult to read as the text tends to blend into the background. On the contrary, a text printed on a pastel background is legible as the scanner will not reproduce the background. The requirements relating to these inks are defined in print contrast signal. All pre-printed labels in a Cheque and MICR code-line, which will be read by the machine, shall be printed in highly reflective black ink with PCS of more than 0.60 to ensure high print contrast signal required to distinguish essential information from the background. The areas (including format boxes) and lines surrounding the required information fields shall have PCS of 0.30 or less to facilitate accurate and fast capturing of information by imaging technologies such as Optical Character Recognition (OCR) and Intelligent Character Recognition (ICR). The OCR systems can be used to read fonts particularly information in the MICR Code Line. The ICR can be used to read hand written or machine printed information on the Cheque.

10.1. Automated Signature Verification Friendly Cheque

A Cheque imaging technique is aimed to facilitate an automation of Cheque signature(s) verification. For this purpose the alignment and background of Cheque signature areas was designed and specified for this purpose.

The background printing in the squares of Cheque signature areas are required to provide a Cheque imaging level that accommodates for image conversions from grey scales to binary black and white as well as scanning in binary format.

10.2. Background of the Cheque

The background printed on the Cheques shall be image-friendly and shall cover only the business area of the Cheque (excluding the MICR clear band area). Background screening or designs shall be printed in a manner with a colour(s) and/or a pattern(s), which ensure the clarity of imaginary or scanning for recognition of any printed or written information on the Cheque; and secure against fraudulent reproduction of Cheques and alteration of information. The scan non readable light pastel colours and standard safety tints are suitable for background screening and heavily reflective ink, heavy inks and dark colours shall be avoided.

It is desirable if the background design of a Cheque could be printed using water soluble and chemically soluble inks, enabling the Bank to identify easily any fraudulent attempt to change information on the Cheque. Banks may print pictorial backgrounds,

but shall not interfere with the legibility of any information, either printed or written on the original Cheque or appear on its image.

Background printing/tinting process shall not affect the quality of subsequent MICR E-13B character printing. It is recommended to have a constantly high average background reflectance (ABR) greater than 60% (0.60).

In order to facilitate conversion of electronic greyscale images to binary images and to minimise the size of the electronic image file any information, either printed or written on the original Cheque shall not be obscured by the background clutter.

10.3. Areas of Interests (AOIs)

The following areas are considered as "Areas of Interest (AOI)" since they contain critical information of Cheques which is to be imaged:

- Drawee Bank/branch name;
- Amount in figures field (convenience amount rectangle) and the BD Label);
- Amount in words field ;
- Date field;
- Drawer/s signature/s field;
- Payee name;
- Drawer information.

The ABR value of amount in figures field and date field must be greater than 60%. The average background reflectance (ABR) value of other AOIs shall be greater than 40% to ensure that those mandatory information boxes are easily visible to the human eye. Any scan readable printing (other than the labels specified as scan readable in this document) that exceeds PCS 0.30 shall not be present in these AOIs to avoid interference with the mandatory information. Inverse printing and slanted printing shall not be used for in AOIs. The Paxel count of background in AOIs shall be 12 or less.

10.4. Date and Amount Boxes

In order to facilitate imaging, the date box and amount in figure box shall be printed in a manner with an average background reflectance (ABR) value greater than 60% to ensure that those AOIs which carry mandatory information boxes are easily visible to the human eye. A low contrast border or outline may be printed outside those boxes in scan non readable white or light pastel colours, such that the PCS of the lines with respect to its background does not exceed 0.30. If not, boxes may be printed in a different shade or of light pastel colours. The PCS of the background printing immediately outside the date and amount boxes shall have a PCS less than 0.30.

10.5. Pre Printed Labels of Mandatory Fields

The pre-printed labels of mandatory fields shall be in Arabic and English to guide Bank customers to fill required information appropriately on the Cheque. The pre-printed label shall be in black or an alternative dark ink to black. All labels shall be visible with a PCS greater than 0.60 relative to the darkest parts of the immediately adjacent area. The currency symbol shall be printed in bold letters.

10.6. Printing on the Reverse of the Cheque

Backgrounds in the reverse side of the Cheque shall be printed in scan non readable ink(s) to avoid any interference with endorsements of customers and stamps placed by Banks and the Clearing House.

10.7. Security Features

In order to detect any fraudulent alterations and counterfeiting, Banks and their corporate customers who print their Cheques on their own shall apply security features to their Cheques.

Figure 7: Invisible security features (as in Annexure VI)

10.7.1. Mandatory Security Features

i. Print Cheques on chemical sensitised and watermarked paper which is UV (Ultra Violet) dull;

ii. Use an unobtrusive Solvent-soluble and aqua fugitive (water-soluble) ink security pattern with a micro print of the Bank name repeated over and over again to show any fraudulent alterations by reaction to liquids or physical alteration. Regular patterns are recommended as irregular patterns have a potential to merge with such altered areas. Labels should be printed darker than this background printing. Background printing shall not interfere with labels and extraction of any information entered in AOIs ;

iii. Use a Thermo-chromic ink security pattern;

iv. Print „PS-ECC" UV printing on the fields viz. the date, payee name, amount in words and amount in figures fields using yellow and/or green colour(Annexure VI); and

v. Printing of Cheques by a recognised Cheque printing press under controlled conditions and print the name of the Cheque printing press vertically along the left edge above the MICR clear band.

10.7.2. Optional Security Features

Banks may optionally apply any additional security features given in later clauses below. Such features shall not adversely affect any stipulated standards and specifications, particularly the legibility of any printed or written mandatory information in areas (viz. the clear band area, the date field, Drawee Bank name, the payee name, the amount in figures field, the amount in words and signature area) on the original Cheque, or reproduction of it through microfilming, scanning or photocopying. Any security features including “void” or “copy” pantographs and other hidden pantographs that are designed to appear on copies to prevent fraudulent duplication shall not be visible on images captured from original Cheques.

10.7.3. Paper Security Features

- **Sensitisation**: Papers shall be chemically sensitized to visibly react a colour „flash –up" against tampering by water, water based chemicals, solvents, bleaches and acids;
- **Watermark**: A three dimensional "3D" watermark with a fine design, which could be easily identified against the light, but difficult to reproduce by a scanning device is permitted. Such watermark shall not adversely affect the MICR printing or imaging.

10.7.4. Primary Ink Security Features

- **Aqueous Fugitive** – This ink printed on the Cheque provides a visual alert by completely dissolving and/or the design smudging, if water and/or water based chemicals are applied.
- **Solvent Sensitive** – this ink printed on the Cheque reacts provides a visual alert by dissolving if an organic solvent is applied.
- **Chemical Sensitive** – In the case of tampering by applying solvents, bleaches, acids etc., this ink printed on the Cheque provides a visual alert by changing colour.

10.7.5. Secondary Ink Security Features

- **Visible and Invisible Fluorescent** – these inks give a bright white effect under UV light.
- **Metallic** – provide effective defence against colour scanning, mainly by reproducing a darker image. This feature may be used in a relatively smaller area such as a company logo.
- **Metameric** – an area printed using two colours of Metameric inks will appear in the same colour when viewed under a standard light source, but appear differently when viewed under a different light source.
- **Intaglio** –under the intaglio printing process, this ink results a "raised" effect.
- **Thermochromic**- These inks are used to create an image that changes colour or disappear when the temperature is raised by a finger. The colour change is not being a permanent effect.
- **Photochromatic**- These colourless inks develop a colour when exposed to UV or strong light. The colour change is not be a permanent effect

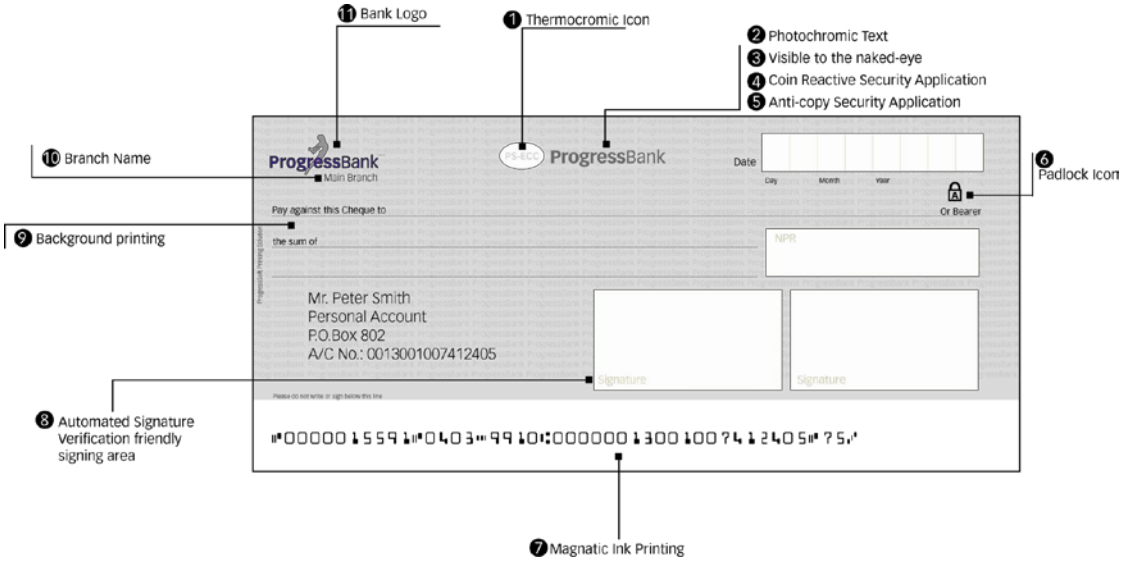


Figure 8: Other visual security features (as in Annexure VII)

10.7.6. Design Security Feature

- **Fine Line Security Patterns** – these are to be printed as patterns of intertwining lines;
- **Guilloche/ Rosette** – this is a free standing fine line design, which can be overprinted, either visibly or invisibly, onto existing security patterns;
- **Micro Printing** – extremely small wording, this can appear as a line or design on the Cheque. It can be read under magnification. Micro printed features are difficult to scan.
- **Vignettes** – Cheques printed using Vignettes are generally difficult to scan. This design feature is created by gradually reducing dot sizes, which give a fading effect. Subtle colours are generally used to print this design feature.
- **Rainbow or Split Duct** – Continuous fading from one colour to another across the document. It creates difficulty in all method of counterfeiting.
- **Holograms** - A hologram shall be restricted to a very smaller area and may be located at the top left hand corner of the Cheque. It shall not result in any embossment or distortion of the paper to avoid paper jam.

10.8. Handling of Cheques

The body of the Cheque shall be free from any perforation, holes or other incisions. Any attachments of adhesions are not permitted on the Cheques. Any stubs or perforated pin fed margins shall be removed before sending for clearing, as these can create paper jams and damage to the sorters. The bottom and the right edges shall be horizontal and vertical to the MICR code line.

10.9. Completion of a Cheque

Where the payee name is printed using a computer or a typewriter, the payee name shall be left justified and the space to the right of the payee name shall be filled with asterisks. The amount in words shall left justified and be preceded and followed by two asterisks. Banks shall also educate their customers on the provisions of this clause.

10.10. Computer Printers

Where the mandatory information fields in the Cheque are to be filled using a computer, a well maintained impact printer with image friendly permanent dark ink ribbons, shall be used.

10.11. Typewriters

Where the mandatory information fields in the Cheques are filled using typewriters, ribbons of dark colours shall be used. The total transfer (correctable) ribbons shall not be used.

10.12. Hand-written Cheque

Where the mandatory information fields in the Cheques are filled by hand, indelible pen (ballpoint) or permanent ink of dark colours, such as black or blue, shall be used. Company rubber stamp, pencils, fugitive or non permanent ink shall not be used. Banks and their customers shall refrain from circling or underlining of information and keep free the areas of interest (AOIs)

10.13. Handling Printing Presses

Banks shall satisfy themselves regarding the proficiency, capacity and security of their printing presses to satisfy their requirements and to meet Cheque Standards and Specifications.

A Bank shall approve layout, proofs and MICR encoding of its own as well as its corporate customers" Cheques prior to printing. A Bank must satisfy itself with respect to the general acceptability of the Cheque, including minimum design features and security features specified in these standards, before giving its approval to a “proof”.

Banks shall instruct their corporate customers to adhere to these standards and to refer the proofs of the proposed Cheques to their Banks for approval before any printing costs are incurred. A Bank shall not approve the design/layout of corporate customers" Cheques unless it complies with these standards. Banks shall safe-keep a reference sample of corporate customers" Cheques they had approved. Any order from a corporate customer to a printing press shall be accompanied by the drawee Bank"s approval. The respective drawee Banks are responsible for adherence to standards by their corporate customers.

Banks and corporate customers of Banks who fail to comply with this requirement may be subject to additional charges and/or may be requested to re-print at their own cost.

11. Glossary

The following table defines a glossary of terms and important conventions used in this Cheque design and specifications document. It is provided here for your assistance and help as a guideline to terms used in this field of operations.

Air Resistance:	The resistance of paper to a passage of air under a specified pressure through paper is defined as air resistance. It is measured as the average time in seconds required displacing 100ml of air through a one square inch (25.4 mm2) area of paper under pressure of 4.88 inches (123.952 mm) of water. If the air resistance is too low, the documents are likely to cause double feeds in sorter transport systems.
Aligning Edge :	The bottom edge of the Cheque, when its face or back is viewed.
Alignment:	Vertical variation between bottom edges of adjacent MICR characters.
Area of Interest (AOI):	An imaginary rectangular area of ¼ inch (6.35 mm) high along the length of following essential data fields or areas, required to optimize image character recognition: ▪ Drawee Bank/branch name; ▪ Amount in figures field (convenience amount rectangle); ▪ Amount in words field ; ▪ Date field; ▪ Drawer/s signature/s field; ▪ Payee name; ▪ Drawer information.

Average Background Reflectance (ABR):	Average background reflectance is the simple arithmetic average of the background reflectance from at least five different points on a paper sheet. It is expressed as a Percentage.
Basis Weight:	Basis weight is an industry term to indicate the weight per unit area of paper. It is a fundamental property of paper board. The weight per unit area is expressed as grams per square metre (GSM or g/m2), pounds per 1,000 sq. ft. or pounds per ream (500 sheets).
Background:	The basic colour of a Cheque.
Background Clutter:	The remnants of the background in a binary image that could interfere with legibility of written or printed information on the Cheque.
Binary Image:	Black and white image, where each Pixel can be stored in memory by one bit of information since as it is black (value = 1) or white (value = 0).
Calliper:	Calliper is the thickness (stated in millimetres or thousandths of an inch.) of a sheet of paper.
Cheque:	MICR encoded paper payment instruments including Cheques, Banker‟s draft, dividend warrant, pay order, or other documents issued by a clearing house member Bank complying with standards and specifications laid down by NRB, and drawn on a Bank in Nepal payable in Nepalee Rupees and any other such document as NRB may prescribe.

Cheque clearing:	The process by which the presenting Bank present a Cheque to the drawee Bank. This process involves: presenting of Cheques to the Clearing House; sorting; exchanging of Cheques among participating Banks; balancing of the amounts expressed in Cheques exchanged; and consequently deriving the net clearing balances which are settled through the accounts of the Banks maintained with the NRB.
Cheque Image:	A digital representation of the front and the back of the Cheque.
Cheque Truncation:	The conversion of a Cheque into an electronic debit or image of a Cheque. This minimises or eliminates in whole or in part, the physical movement of Cheques in the clearing process by replacing the physical Cheque by electronic records and/or images of their contents for further processing and transmission.
Continuous Form Cheques:	Cheques manufactured in a manner to join a set of Cheques together to facilitate automated feeding to a printer for the purpose of printing.
Debossment:	Printing that is pressed into the paper.
Drawer:	The person who issues a Cheque.
Drawee Bank:	The Bank on which a Cheque is drawn. It holds the drawer‟s account on which a Cheque is drawn.

E-13B:	One of the standard fonts for MICR characters. Those are printed in accordance with the standards of ISO (International Standardisation Organisation).
Embossment:	Printing process that results in the characters being raised above the surface of the paper.
Field:	A rectangular region of an image that is assigned for characters to be recognised.
Grain Direction:	The direction in which most of its fibres lie. The paper properties largely depend on the grain direction. Long grain papers have fibres aligned with or parallel to the long dimension of the sheet. In contrast fibres of short grain papers are aligned with the shot dimension. Papers having weight of 24 pounds (90 g.s.m.) more can be used in either grain direction.
Greyscale image:	An image where each pixel can have a full range of grey tonal values, between 16 and 256 levels. This varies according to the system used.
Image:	Image refers to a digital representation of a Cheque, either a greyscale image (120 dpi) or a binary image (minimum 200 dpi).
Imaging:	The process involve in taking copies of both sides of a Cheque and storing in an electronic file as a digitised picture, which could be identified by a unique identifier code.

Imaged base Cheque Truncation:	A system which replaces the physical movement of Cheques at some point en-route to the drawee branch by the Cheque"s electronic image and relevant data throughout the entire clearing cycle. The paper Cheque doesn"t move from the collecting Bank/clearing house to the paying Bank for the purpose of debiting the drawer"s account.
Image Friendly:	A Cheque becomes image friendly when its features or the location of its features support the legibility of the written or printed information and does not result a heavy storage requirement to the compressed image.
Legible:	Information on the Cheque is considered as legible, when it is cable of being read. To fulfil this requirement Information contained in the Cheque must be of sufficient quality to be easily and accurately recognised, under a specified set of conditions. Under the Cheque imaging environment, low average background reflectance may result low contrast with written data, which can adversely affect the binary image. Excessive background clutter existing in a binary image may also interfere with identification of written data by a human eye.
Long Grain Paper:	Fibres of the paper are aligned with the long dimension of the sheet.
Magnetic Ink Character Recognition (MICR):	A process by which Cheques are printed using magnetic ink and characters of a special design to create machine readable information for fast automated document processing. These characters can be recognised visually and also be processed by high speed magnetic recognition equipment.
MICR Clear Band	An area 7/8 inch (22.225 mm) high, measured vertically

Area:	from the bottom reference edge of the Cheque. This area runs along the bottom reference edge, from the right edge to the left vertical edge of a Cheque. The MICR code line is printed in the MICR clear band area.
MICR Code Line:	The line of Magnetic Ink Character Recognition numbers at the bottom of a Cheque in the clear band area printed in magnetic ink, which can be read by machines to facilitate automated data capture. The MICR code line has an established format, which consists of fields viz. amount field, transaction code field, account number field, Bank/branch code field, Cheque serial number field. The MICR line should be printed using a special font and magnetic ink.
Paper Curl:	A systemic deviation of a paper sheet from a flat form. Curls may results from the release of stresses that are introduced into a paper sheet during its manufacturing process or subsequent usage.
Payee:	The party to which a Cheque is payable.
Paying Bank:	The Bank on which a Cheque is drawn and which pays the amount for which the Cheque is written by deducting the respective amount from the customer‟s account.
Paxel:	A group (about 6 to 9) of black Pixels in a binary image (0.01 squared). That is the smallest dark area of background clutter, which can exert an impact on the legibility of hand written data on images.

Pixel:	The smallest area of a Cheque considered in capturing an electronic image.
Presenting Bank:	A Bank, which collects and presents Cheques or their images for clearing on behalf of its customers.
Print Contrast Signal (PCS):	The PCS is a ratio of the difference of the reflectance of a particular printed point and the reflectance of the background on which it is printed. This is expressed on a scale of zero to one. A dark colour has a low reflectance relative to the paper it is printed on, to which the PCS method gives a high value. A light colour has a high reflectance and has a low PCS value. Mathematically PCS is defined as: $PCS_B=(R_B - R_P)/ R_B$ Where: R_B: is the average reflectance of the background within the area of interest R_P: is the reflectance of a small measurement area centred on point P. The reflectance, and the PCS, is measured with an aperture 0.008 inch (0.2032 mm) in diameter. This measurement is carried out by using the black-backing method.
Reflectance:	The relative brightness of an illuminated paper surface as seen by the human eye. It is expressed as a value between 0 and 100%.

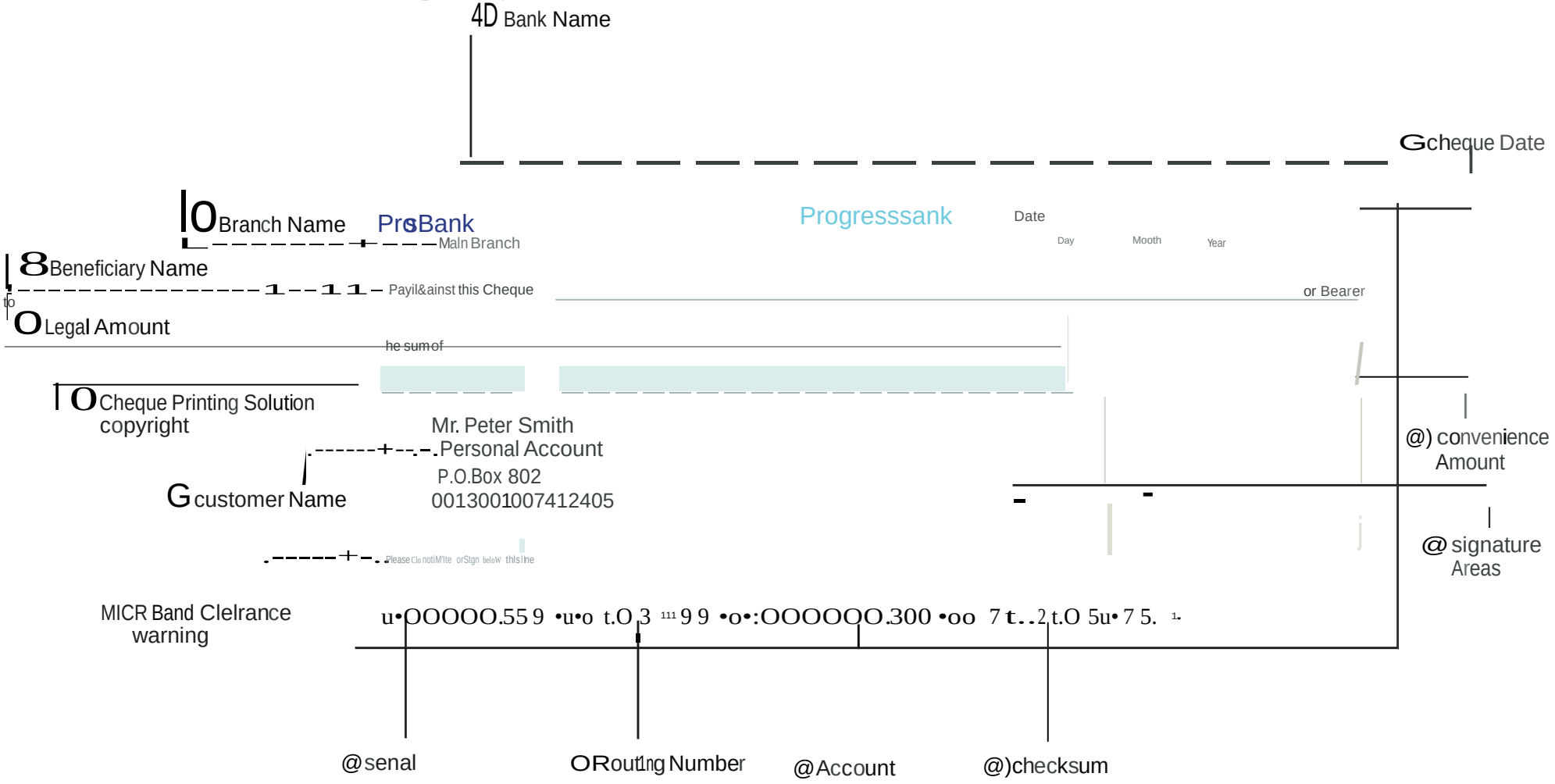
Right Reference Edge:	The right edge of a Cheque when its face is viewed. The left edge of the payment item when its back is viewed. This is also called as the leading edge.
Stiffness:	The rigidity or bending movement that the paper can withstand is defined as stiffness. Generally thicker papers are stiffer. Too lighter papers are likely to bunch up or wrinkle in the reader sorters. Too heavier papers lead to paper jam due to their less ability to bend.
Thickness or caliper:	Thickness is the density of a sheet of paper with a given basis weight. Uniform thickness is important for quality printing. It is expressed in micrometers or thousandths of an inch.

12. References

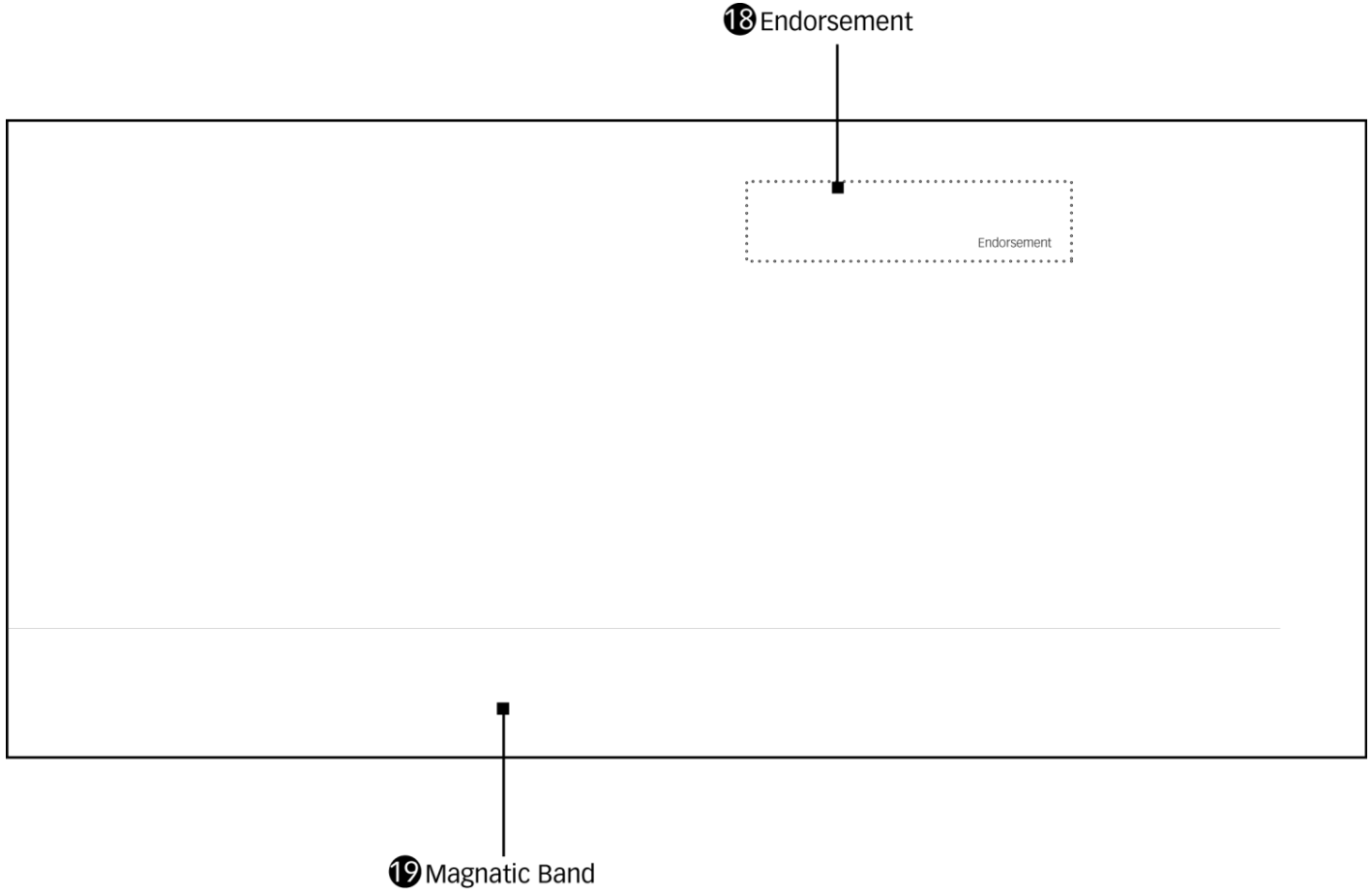
The following references where used to build this cheque design and specifications as per the latest technologies in secure document printing in the field of banking instruments.

NDP Series:	Payment Systems Document Design and Performance Guidelines.
ANS X9.7:	Bank Check Background and Convenience Amount Field Specification.
ANS X9.13:	Specifications for Placement and Location of MICR Printing.
ANS X9.18:	Paper Specifications for Checks.
ANS X9.27:	Print and Test Specifications for Magnetic Ink Character Recognition (MICR).
ANS X9.29;	Check Carrier Envelopes Specification.
ANS X9.33:	Specification for Bank Deposited Tickets.
ANS X9.40;	Check Correction Strip Specification.
ANS X9.51:	Specifications for the Padlock Icon
X9/TG-2:	Understanding and Designing Checks.
X9/TG-8-2002:	Check Security Guideline
X9/TG-6:	Quality Control of MICR Documents.
ISO-1004:	Information Processing – Magnetic Ink Character recognition – Print Specifications.

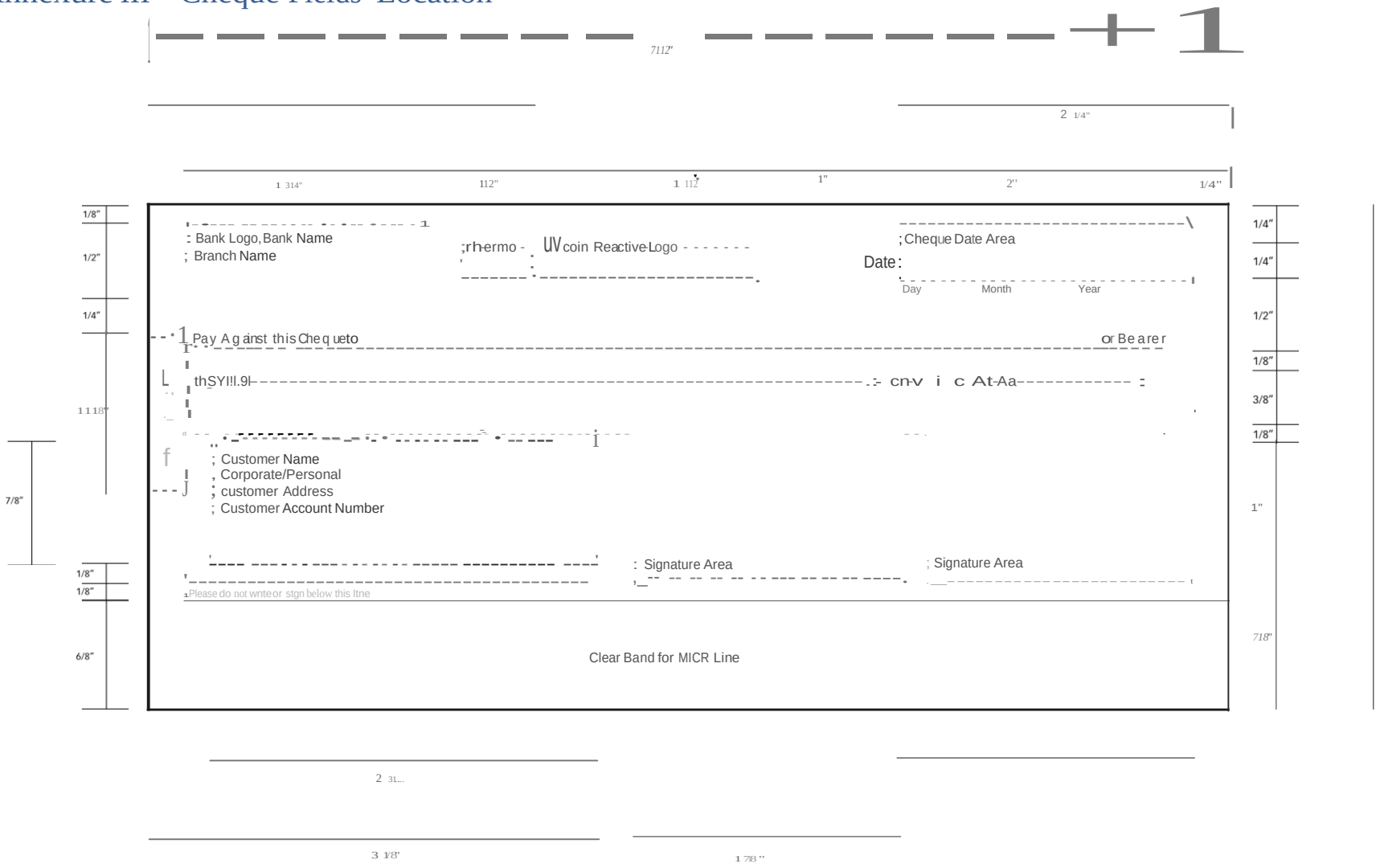
13. Annexure I – General Cheque Layout



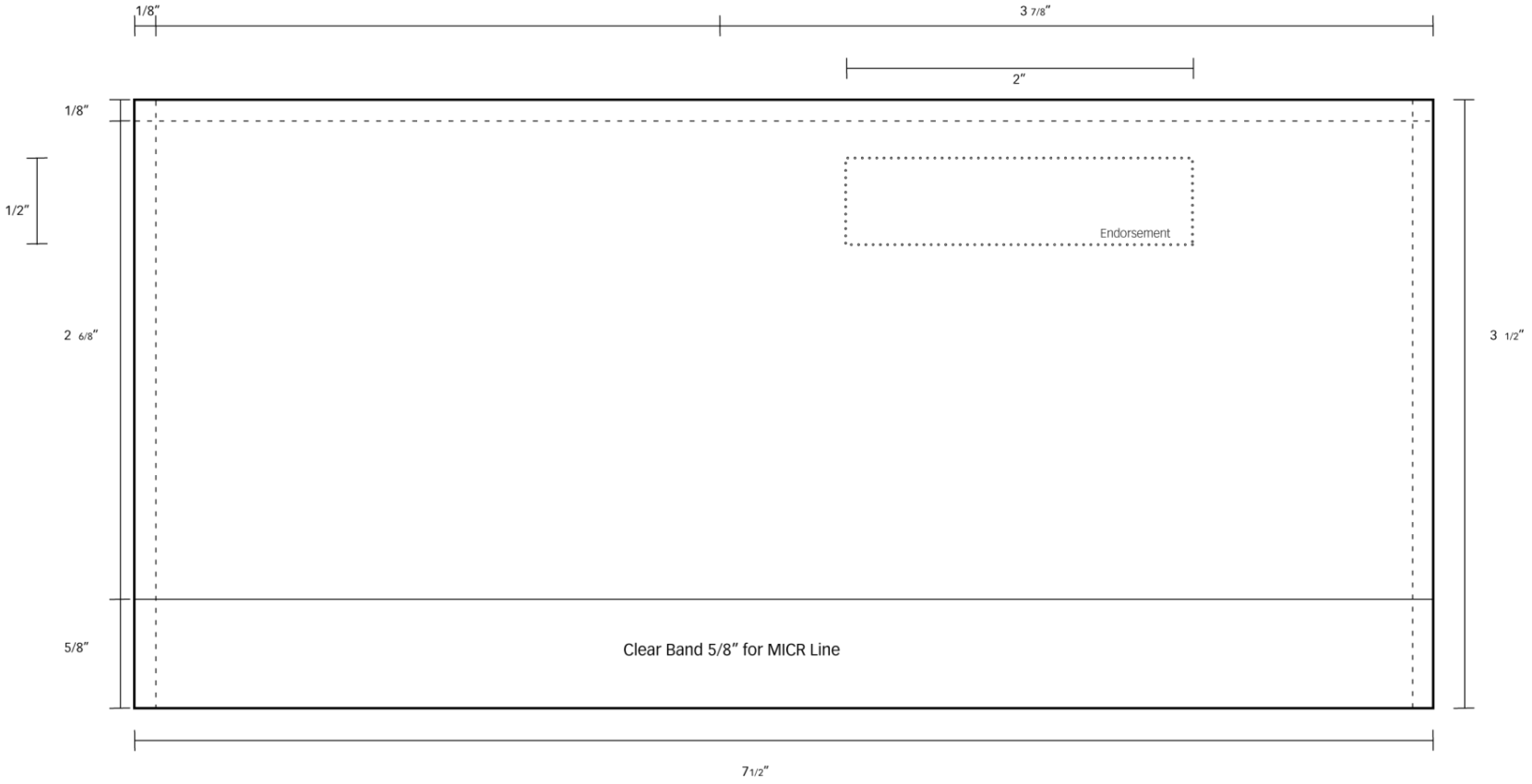
14. Annexure II – Back of Cheque Layout



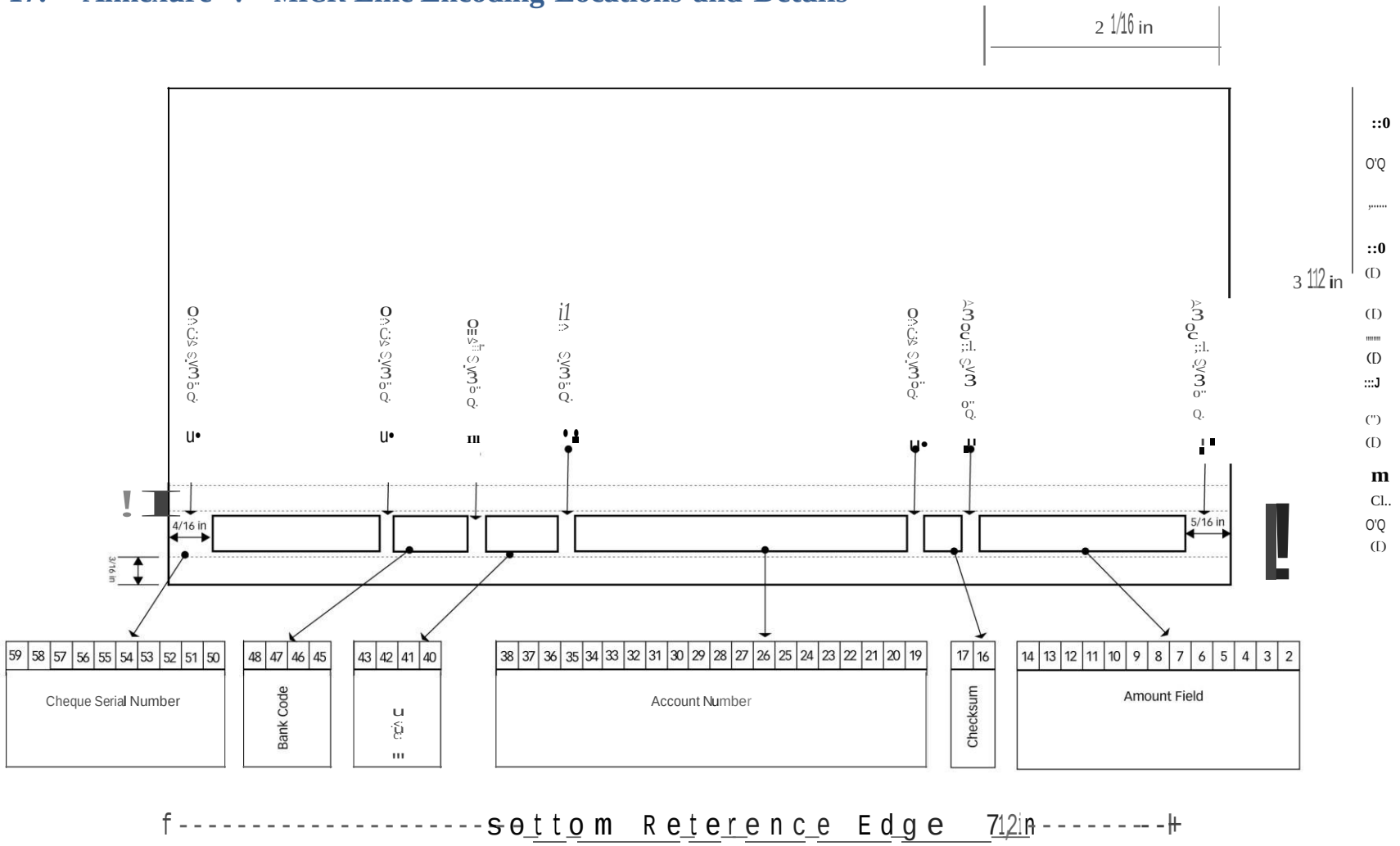
15. Annexure III – Cheque Fields Location



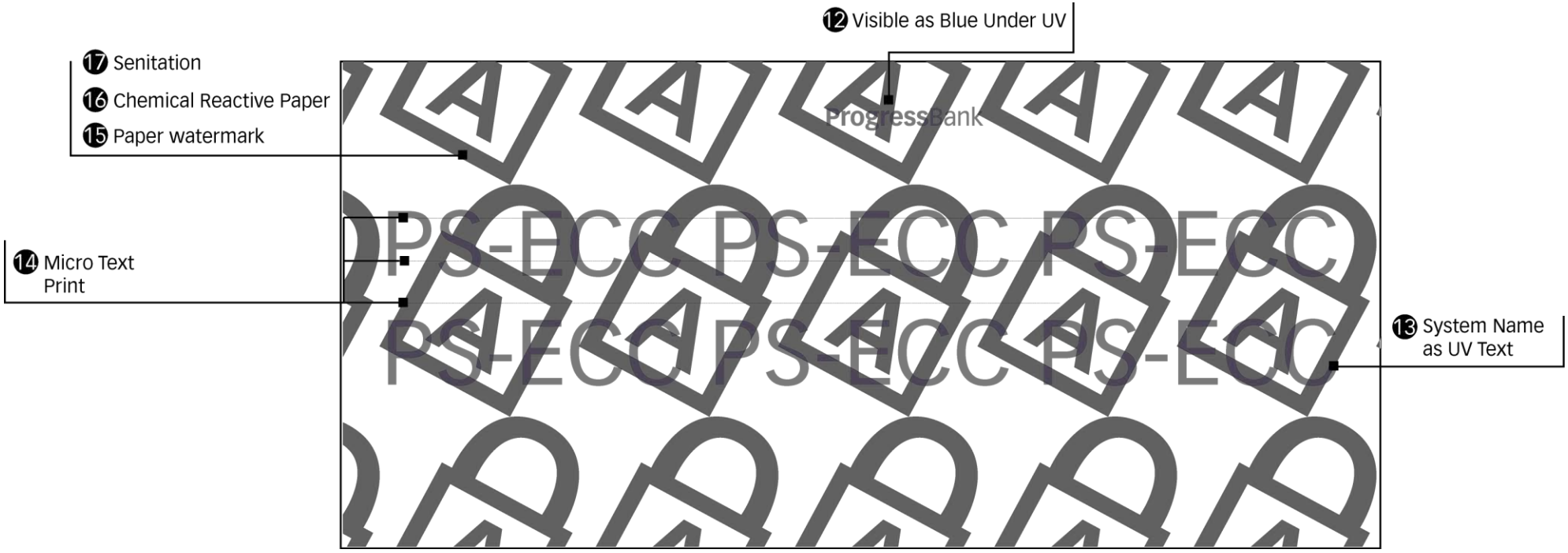
16. Annexure IV – Back of Cheque Fields Locations



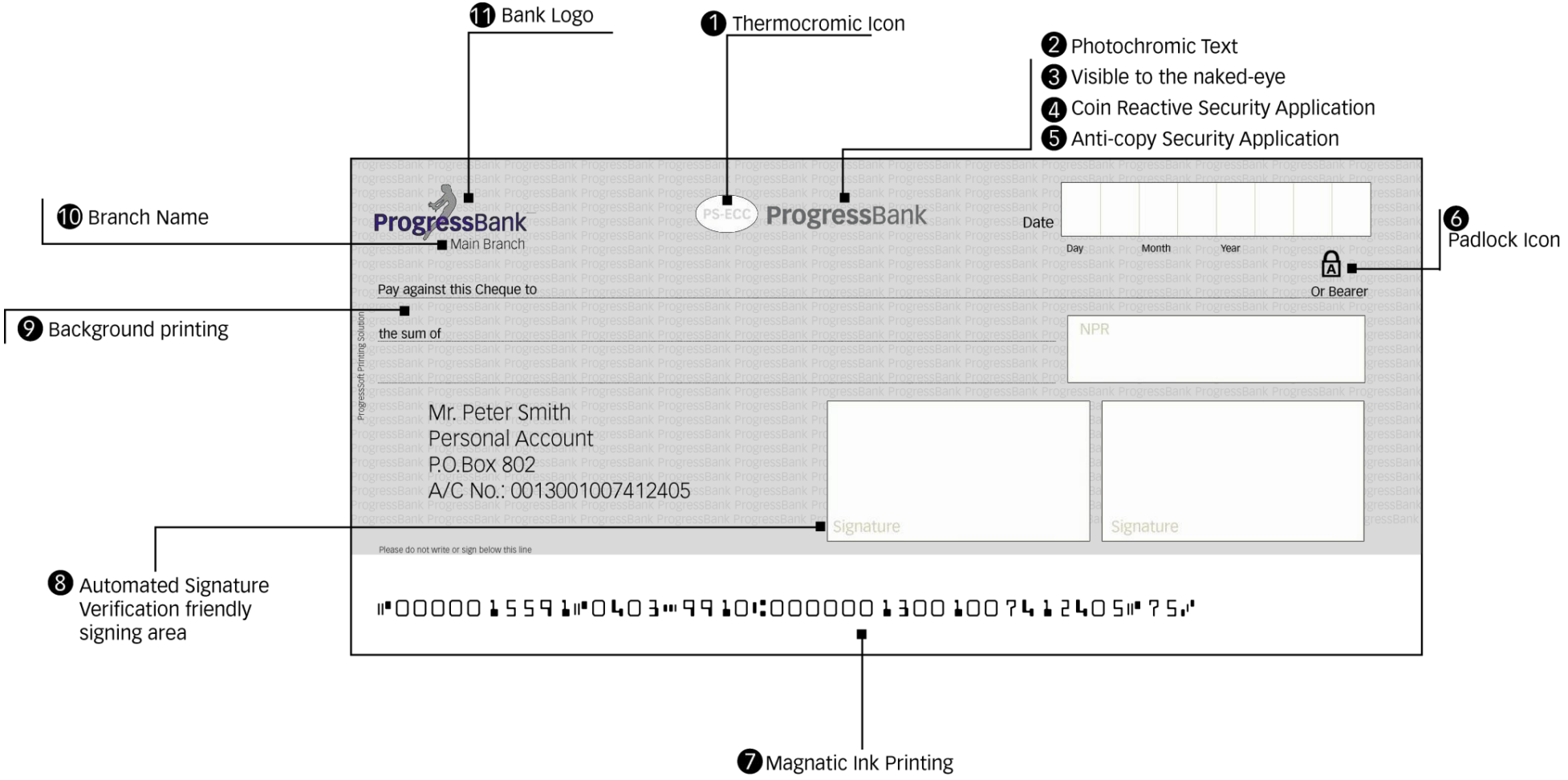
17. Annexure V- MICR Line Encoding Locations and Details



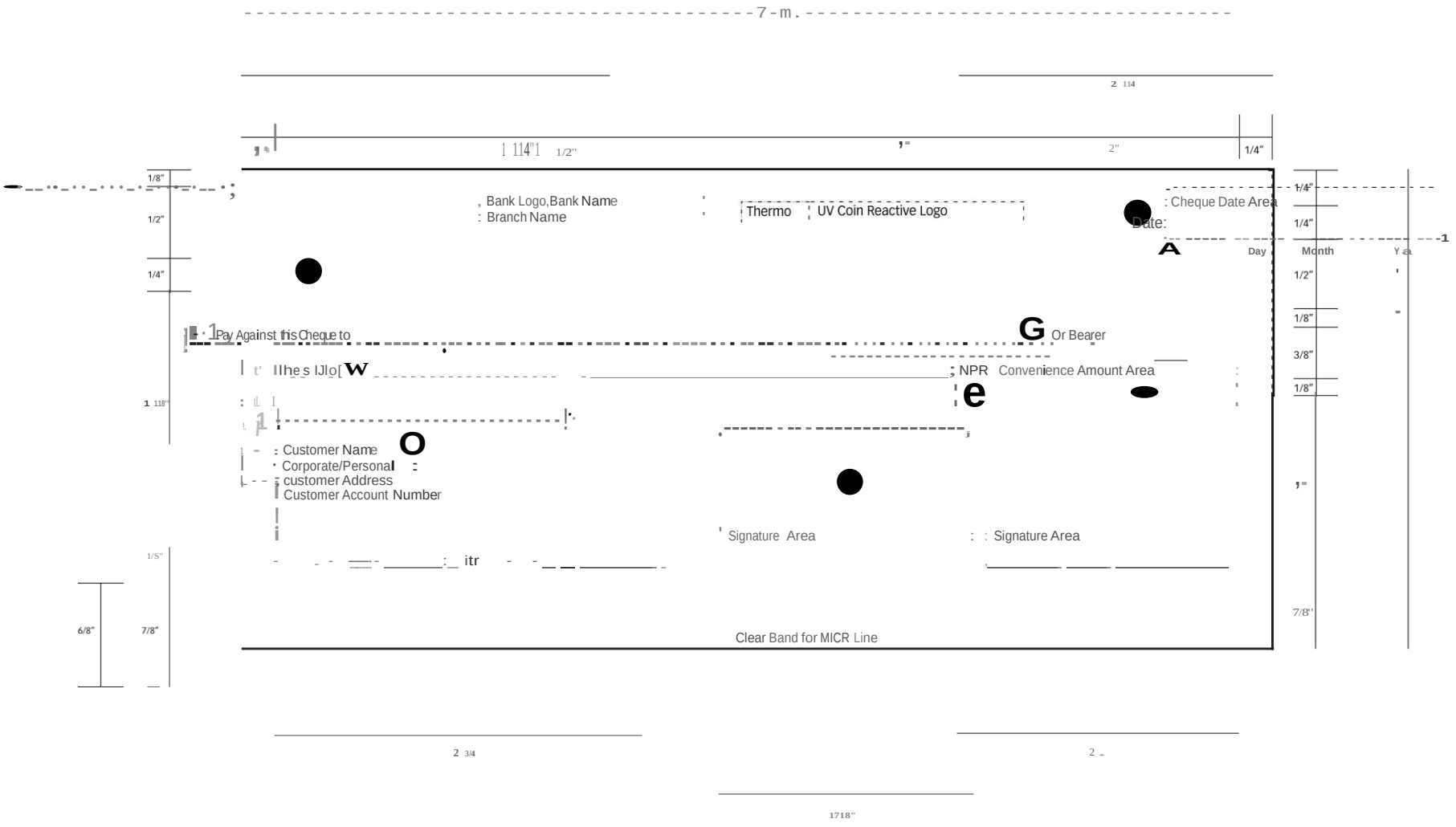
18. Annexure VI – Invisible Security Features



19. Annexure VII – Other Visual Security Features



20. Annexure VIII- Fields Reference Layout



21. Annexure IX – LUHN MOD100 Checksum Algorithm

																																	Digits Sum	MOD100	Checksum
MICR Code Line	0	0	0	1	5	5	9	1	0	4	0	3	9	9	1	0	0	0	1	3	0	0	1	0	0	7	4	1	2	4	0	5			
Double every other	0	0	0	2	5	10	9	2	0	8	0	6	9	18	1	0	0	0	1	6	0	0	1	0	0	14	4	2	2	8	0	10			
Single Digits	0 0	0 0	0 0	0 2	0 5	1 0	0 9	0 2	0 0	0 8	0 0	0 6	0 9	1 8	0 1	0 0	0 0	0 0	0 1	0 6	0 0	0 0	0 1	0 0	0 0	1 4	0 4	0 2	0 2	0 8	0 0	1 0	82	82	18

This is a modulated checksum algorithm based on LUHN algorithm except that the checksum is the complimentary MOD100 instead of MOD10. The steps towards calculating the checksum goes as follows:

1. The first row is the digits that fulfil the MICR line encoding parts including all fields (from position 19 to position 59) and not including the amount field neither being pre-printed nor power encoded. Digits only are included with MICR symbol characters removed.
2. In the second row each other digit (even digits locations) are doubled (multiplied by 2) keeping the digits in odd locations as is.
3. The third row separates row two digits into single digits so that 18 is split into 1 and 8.
4. All single digits in row three are summed up mathematically as shown in the “Digits Sum” field at the right.
5. The MOD 100 of the digits sum is calculated (82MOD100 is 82).
6. The final checksum is the complimentary of the mod100 value to the 100 (100-82 is 18).

As for the verification applications the total sum of all digits including the final two digits checksum should result in a number with zero modulo of 100.